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Rediscovery of *Passiflora lanceolata* (Mast.) Harms (Passifloraceae) in Peru

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Abstract
Passiflora lanceolata (Mast.) Harms is a poorly known endemic species from the highlands in Peru. This species was believed to be extinct, but it has been found and collected for the first time since 1970. Herein, we increase the general knowledge about *P. lanceolata,* its morphology, and geographical distribution. A description, photographs, and taxonomic comparisons with related species are provided.

Keywords
Endemic species, *Passiflora* supersect. *Tacsonia*, passionflower.

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Introduction

Passiflora L. (Passifloraceae) is a genus of tropical vines that can grow from sea level to altitudes of more than 4000 m. This genus is the largest in the passion flower family, Passifloraceae, with more than 525 species. It stands out for the value of its fruits, its ornamental flowers, and its complex floral ecology (Ulmer and MacDougal 2004). Nowadays, the infrageneric classification recognizes six subgenera: *Astrophea* (DC.) Mast., *Deidamioides* (Harms) Killip, *Decaloba* (DC.) Rchb., *Passiflora* L., *Tetrapathea* (DC.) P.S. Green, and *Tryphostemmatoides* (Harms) Killip, with supersections, sections, and series (Feuillet and MacDougal 2003; Krosnick et al. 2013; Buitrago et al. 2018). The subgenus *Passiflora* is the most diverse and economically important as it possesses the majority of edible fruits (Martin and Nakasone 1970).

Passiflora supersect. *Tacsonia* (Juss.) Feuillet & J.M. MacDougal, a clade from subgenus *Passiflora*, is composed of species of vines adapted to the high mountains in the Andes. The greatest diversity of *Passiflora* supersect. *Tacsonia* is found in Colombia, Ecuador, and Peru, where at least 22 species and one interspecific hybrid are present (Brako and Zarucchi 1993; Ulmer and Schwerdtfeger 2000; Jørgensen and Vásquez 2009; Esquerre-Ibañez 2015; Ocampo et al. 2017). Most of the *Passiflora* supersect. *Tacsonia* species are characterized by the possession of large pendent flowers with a conspicuously developed floral tube specialized for hummingbird pollination (Büchert and Mogens 2001; Ocampo et al. 2017). One of the most important studies about *Passiflora* supersect. *Tacsonia* was by Escobar [1988, treated as *Passiflora* subg. *Tacsonia* (Juss.) Triana & Planch] in which she recognized eight sections within *Tacsonia*,

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accepting the circumscription of the section *Poggendorffia* (H. Karst.) Triana & Planch. within *Tacsonia*.

In 1857, Karsten described the monotypic genus *Poggendorffia* H. Karst. [*Passiflora* sect. *Poggendorffia* sensu Escobar (1988)], which is recognized by the possession of an anomalous androecium with basifixed anthers. Years later it was found that the type species, *Poggendorffia rosea* H. Karst (*Passiflora* × *rosea* (H. Karst.) Killip), represented a natural hybrid between *Passiflora tripartita* var. *mollissima* (Kunth) Holm-Niels. & P. Jørg., a species that belongs to *Passiflora* sect. *Elkea* Feuillet & J.M. MacDougal, and P. *pinnatistipula* Cav., which belongs to *Passiflora* sect. *Insignes* (Harms) Feuillet & J.M. MacDougal (Killip 1938; Chan and Borchardt 2016). Due to this inconsistency, Feuillet and MacDougal (1997) renamed section *Poggendorffia* as *Passiflora* sect. × *Inkea* with *Passiflora* × *rosea* as the only member. The remaining species that used to belong to section *Poggendorffia* were moved to *Passiflora* sect. *Insignes* (Feuillet and MacDougal 1997; Jørgensen and Vásquez 2009).

Passiflora sect. *Insignes* consists of four species endemic to Bolivia, one to Peru, and one widespread species (Jørgensen and Vásquez 2009). Morphologically, these species are grouped due to the presence of pinnatisect stipules and bracts free to the base. Currently, the section *Insignes* is nested within *Passiflora* supersection *Tacsonia* (Escobar 1988; Jørgensen and Vásquez 2009). *Passiflora lanceolata* (Mast.) Harms is one poorly known species from section *Insignes*, which is endemic to Peru and known only by its type material (Killip 1938; León and Jørgensen 2006; Ocampo et al. 2014). According to the IUCN criteria, *Passiflora lanceolata* must be categorized as Critically Endangered because of its small extent of occurrence (Jørgensen and Vásquez 2009; Bonilla 2014). Furthermore, Jørgensen and Vásquez (2009) have suggest that *P. lanceolata* now may be extinct.

Due to its particular morphology, Jørgensen and Vásquez (2009) pointed out that *Passiflora lanceolata* might be a connection between *Passiflora* sect. *Insignes* and the other species of supersection *Tacsonia*.

Methods

During botanical collections carried out in the Department of Ayacucho (Peru) in 2015 we identified a field-collected specimen as *Passiflora*. After a detailed review of the material, it was determined to be *P. lanceolata*, a species endemic to Peru. We also examined type materials from herbaria K and E available through the JSTOR-Global Plants website (http://plants.jstor.org/), and a collection made in 1970 from herbarium NA (*Weske 10386-70*). The morphological terminology follows that of Escobar (1988), Tillett (1988), and Beentje (2016), and the herbarium acronyms follow Thiers (2019).

Results

Passiflora lanceolata (Mast.) Harms, Bot. Jahrb. 18 (Beibl. 46): 11. 1894 [not *P. lanceolata* G. Don, nom. nud. and an orthographic error for *P. lancifolia* Ham.].

Basionym. *Tacsonia lanceolata* Mast. in Mart., Fl. Bras. 13(1): 536. 1872.

Passiflora acutissima Killip, J. Wash. Acad. Sci. 17: 428. 1927 [nom. nov. replacing, unnecessarily, *P. lanceolata* (Mast.) Harms].

Type. PERU. "Andimarca" [Dpto. Amazonas, Prov. Luya, Dto. Santo Tomas, Andamarca], VII-1831–1834, *Mathews 1252* (lectotype, designated by Killip 1938, K! [K000262644]; isolectotype, E! [E00326192]).

Figures 1–3

New record/materials examined. PERU. Ayacucho: Prov. La Mar: Anchihuay de la Selva – Ajojasapampa, 12°58′16.64″S, 073°47′00.93″W, 3500 m, 25 May 2015 (fl.), *R. Fernandez-Hilario 943* (MOL!); Near Cusimachay, c. 25 km NE of Tambo, on W slope of the Rio Apurimac valley at c. 3587 m, 12°49′S, 073°50′W, 28 Jul 1970 (fl.), *J. S. Weske 10386-70* (NA, photo!).

Passiflora lanceolata is endemic to humid montane forests with adjacent grasslands in northern and central Peru (departments of Amazonas and Ayacucho). This species is found at 3500–3600 m a.s.l. in valleys with shallow slopes. The individual *Fernandez-Hilario 943* was recorded growing on a stone fence with other species such as *Caiophora* aff. *cirsiifolia* C. Presl, *Clethra ferruginea* (Ruiz & Pav.) Link ex Spreng., *Gynoxys cuzcoensis* Cuatrec., *Jaltomata herrerae* (C.V. Morton) Mione, *Lepechinia heteromorpha* (Briq.) Epling, *Morella pubescens* (Kunth. ex Willd.) Wilbur, *Polylepis pauta* Hieron., *Siphocampylus vatkeanus* Zahlbr., *Solanum nutans* Ruiz & Pav., *Solanum probolospermum* Bitter, and *Verbesina* sp.

Identification. Vine, glabrous, except for stems, petioles, and peduncles; indument pilose. Leaves unlobed, alternate; stipules 8–15 mm long, lanceolate, reduced to pinnatisect filiform segments, glabrescent to ciliate; petiole 4–10 × c. 0.75 mm, with 2 terminal stipitate glands; lamina 3.4–8.2 × 0.9–1.9 cm, lanceolate, apex acuminate to attenuate, base obtuse to rounded, margin entire and revolute when dry, glabrous, sub-concolorous, the adaxial surface lustrous, sub-chartaceous, the venation eucamptodromous and arcuate, with 10–13 secondary veins. Peduncle 4.6–9.5 cm long; bracts 3, free, involucrate, 20–23 × 8–11 mm, ovate, apex attenuate, fimbriate-glandular, ciliate. Flowers solitary and pendulous, glabrous; pedicel 9–21 mm long; floral cup 13–17 mm in diameter, 8–11 mm long; floral tube 6–9 cm long, lavender; perianth up to 5 cm in diameter, bell-shaped; sepals 35–41 × 10–14 mm, oblong, apex obtuse, abaxially aristate and keeled, awn 2–6 mm long, externally pink and lavender, internally pink; petals slightly smaller than sepals, oblong, apex rounded, pink; corona 2- or

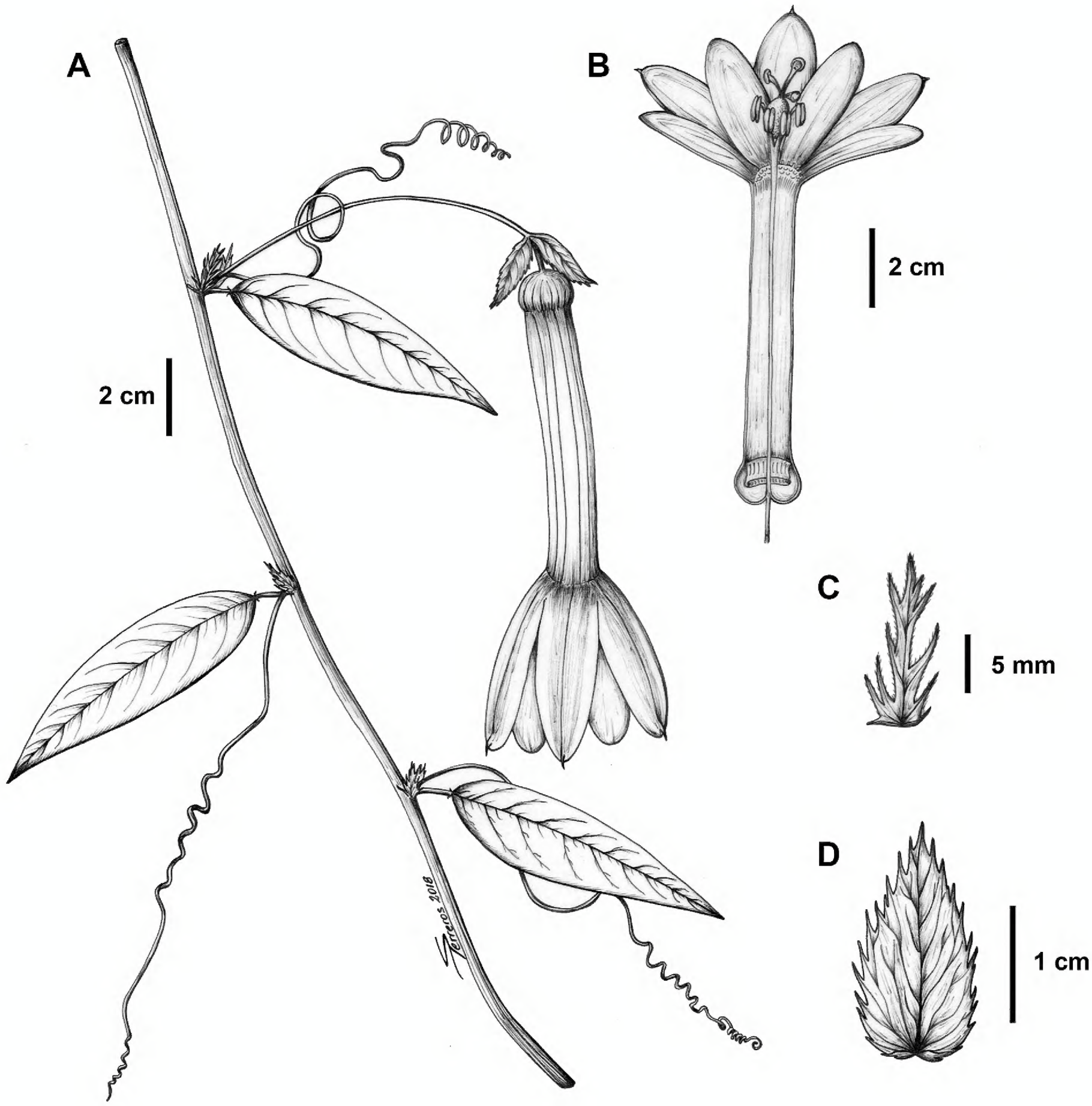

Figure 1. *Passiflora lanceolata*. **A.** Stem with flower. **B.** Inner view of the flower. **C.** Stipule. **D.** Floral bract. From *R. Fernandez 943* (MOL). Drawing by Sara Terreros.

3-ranked, borne at mouth of tube, the outer series of filaments 1 mm long, tuberculiform, violet, the inner series progressively reduced to punctiform appendages; operculum 7 mm long, not plicate, dependent, the margin recurved, denticulate; limen inconspicuous or absent; filaments free before the gynophore, anthers yellow; ovary ellipsoidal, green, glabrous; styles light purple; stigmas globose, light green. Fruits unknown.

A combination of six morphological characteristics make *P. lanceolata* easy to recognize: (1) lanceolate unlobed leaves, (2) pinnatisect stipules, (3) involucrate bracts free to base, (4) floral tube longer than the sepals, (5) corona composed by two or three series of reduced filaments with the outer series tuberculiform and other two progressively reduced to punctiform appendages, and (6) an androecium partially zygomorphic.

Conservation status. The two localities of the Ayacucho region (separated by c. 18 km) are found between the limits of grasslands with humid montane forest, with no to very little anthropic perturbation. It is possible that there are more populations of *P. lanceolata* within this area. The type locality at Andamarca (Amazonas region) currently presents fragmented and disturbed montane forest due to the expansion of agriculture. Jørgensen and Vásquez (2009) assigned a conservation status of Critically Endangered to the species. Following the guidelines of the IUCN (2019), we assign this species to the Endangered category under the criteria B2a+biii.

Discussion

The type locality and the geographical distribution of

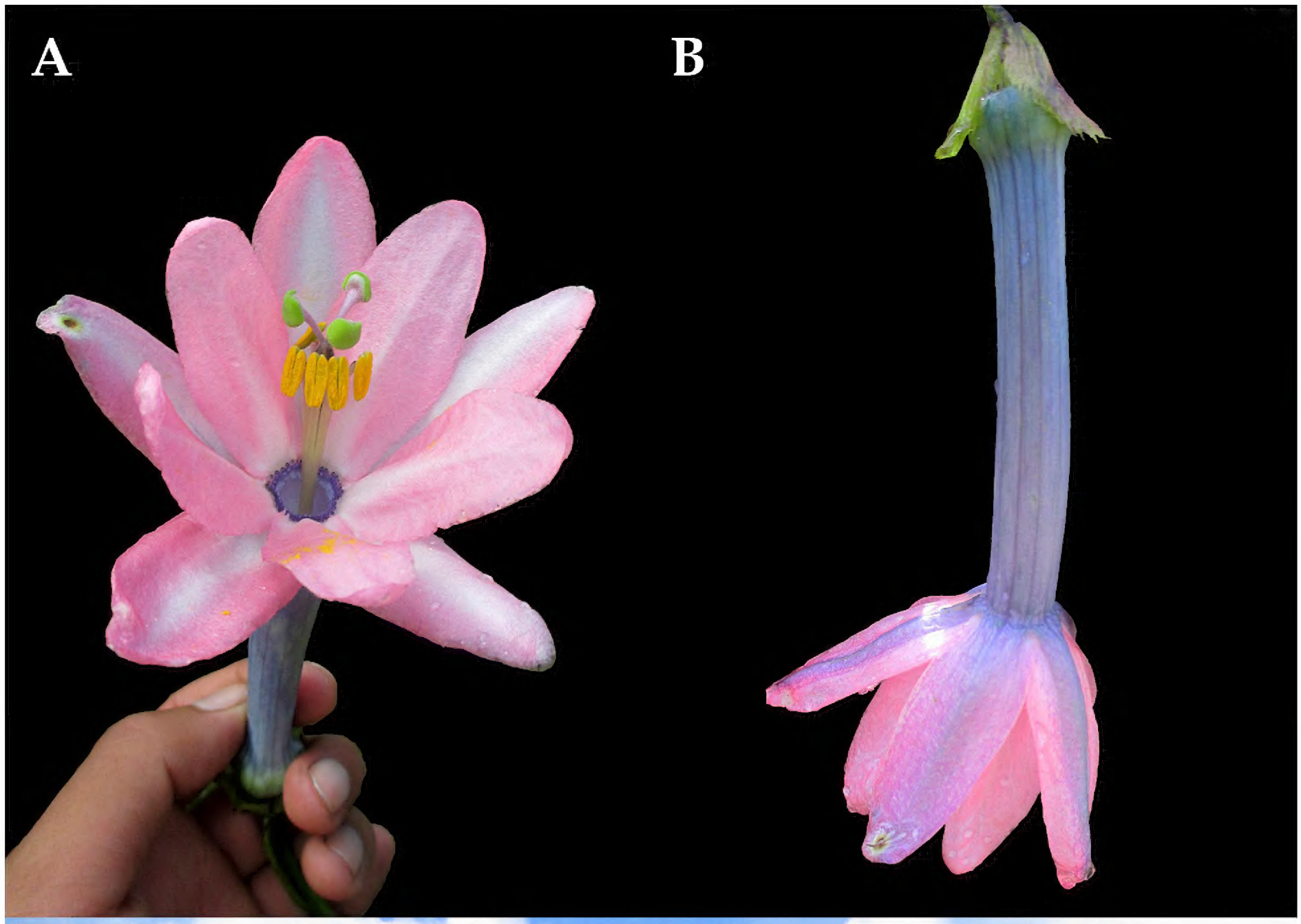

Figure 2. *Passiflora lanceolata*. **A.** Perianth, stamens and pistil. **B.** View lateral of the flower. **C.** Habitat of *P. lanceolata* in La Mar (Ayacucho). Photos by Robin Fernandez.

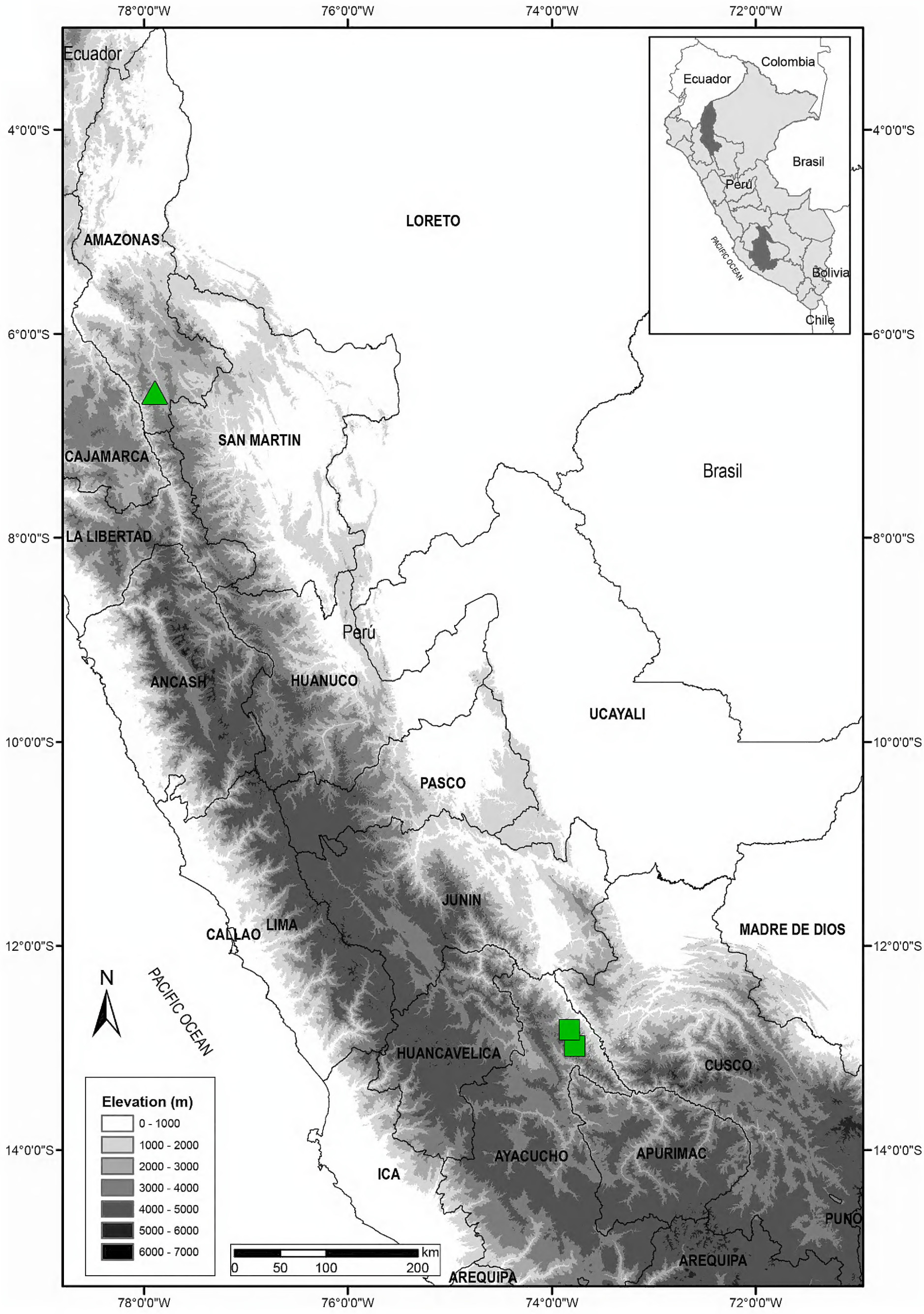

Figure 3. Distribution of *Passiflora lanceolata* in Peru, specimens collected in 1970 and 2015 (squares) and Mathew's collection (triangle).

Passiflora lanceolata are still uncertain. Regarding to the type material (*Mathews 1252*) of *P. lanceolata*, the specimen presents an annotation that says "*Mons Atlis. Andimarca*", and the department where it was collected was not mentioned. In Peru, there is no locality called Andimarca, but there are 13 localities called Andamarca in various departments. One of these localities is located in the province of Luya in the department of Amazonas, whereas another three localities are in various provinces within the department of Junín. Previously, Killip (1938) and León and Jørgensen (2006) indicated that the type material of *P. lanceolata* was probably collected from department of Amazonas, in northern Peru. Subsequently, Escobar (1988) interpreted that Andamarca was located in the department of Junín, in central Peru, and that interpretation was considered correct because B. León indicated that the locality of *Ancylogyne capitata* Nees (*Mathews 1230*) was located in the province of Concepción in the department of Junín (Jørgensen and Vásquez 2009). However, after searching for Mathew's specimens in K, we observed that the specimen *Mathews 1247* (http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000613160) presents an annotation that says "*Lomas of Lurin*", an area located in the department of Lima on the Peruvian coast, while the specimen *Mathew 1253* (http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000329236) indicates "*Bajasan Prov. Chachapoyas*". Currently, the locality called Bagazán is located in the province of Luya in the department of Amazonas. Additionally, Bagazán is appropriately located 10 km from the city of Chachapoyas and 40 km from Andamarca. Therefore, we consider that the type material of *P. lanceolata* comes from of district province of Luya in the department of Amazonas.

Passiflora sect. *Insignes* had a geographical origin between the Andean region of Bolivia and southern Peru (Escobar 1988). *Passiflora pinnatistipula* is the only species with broad distribution, and this species is cultivated from southern Chile to northern Colombia. For this reason, *P. lanceolata* is the only exclusively wild species from the section *Insignes* inhabiting low latitudes. In the revision of *Passiflora* sect. *Insignes* (Jørgensen and Vásquez 2009), the description of *P. lanceolata* was based only on the type material and lacks precision, as some structures like the corona, limen, operculum, and inside of the floral tube were not observed. The corona was believed to be composed of only one series of reduced filaments (Killip 1938). Nevertheless, it is actually composed by two or three series of reduced filaments; the outer series measure about 1 mm, and other two are progressively reduced to punctiform appendages. The inner surface of the floral tube does not present any filiform appendages like in other species of *Passiflora* sect. *Insignes* (e.g. *P. pinnatistipula*, *P. pilosicorona* Sacco, and *P. carrascoensis* P. Jør. & R. Vásquez) (Jørgensen and Vásquez 2009). The androecium is partially zygomorphic, a characteristic never seen in section *Insignes*, but in other species of supersection *Tacsonia* (e.g. *P. trifoliata* Cav., *P. mathewsii* (Mast.) Killip, *P. jamesonii* (Mast.) Bailey, and *P. trisecta* Mast.). Although the zygomorphic androecium is a characteristic frequently present in bat pollinated species (Sazima and Sazima 1978; Jørgensen et al. 2012), we suggest that *P. lanceolata* is pollinated mainly by hummingbirds because of the pendulum position of the flowers, the length of the floral tube, and the coloration of the flowers (Büchert and Mogens 2001). The operculum with the recurved and minutely denticulate margin is similar to the majority of species of section *Insignes*, with the exception of *P. carrascoensis*, which presents a reflexed operculum with denticulate margin.

According of the particular morphology of *P. lanceolata*, some authors have suggested that this species is the connection between section *Insignes* and the rest of species from supersection *Tacsonia* (Escobar 1988; Jørgensen and Vásquez 2009). All species from section *Insignes* possess pinnatisect stipules and bracts free to base, but *P. lanceolata* is the only one with unlobed leaves. Additionally, it possesses the longest floral tube among the section *Insignes*, with a similar size to what can be observed in *Passiflora* sect. *Tacsonia* and *Passiflora* sect. *Elkea*. Moreover, *P. lanceolata* is the only known Peruvian species with unlobed leaves from *Passiflora* supersect. *Tacsonia* (Killip 1938). This characteristic is very uncommon in *Passiflora* supersect. *Tacsonia*, only seen in some species of *Passiflora* sect. *Colombiana* L.K. Escobar from Colombia, Ecuador, and Venezuela (Escobar 1988) and the closely related *P. insignes* from Bolivia.

Due to the relatively short floral tube of the species from section *Insignes* and their partially reduced corona, morphological analyses have placed section *Insignes* as a subclade closer to section *Manicata*, an intermediate clade between the *Tacsonia*/*Elkea* species and section *Colombiana* (Ocampo and Coppens d'Eeckenbrugge 2017). However, *P. lanceolata* possesses a floral tube longer than the sepals, the longest among *Insignes*. Additionally, the pinnate stipules of the species from section *Insignes* could indicate an intermediate state between the foliate and reniform stipules of sections *Elkea* and *Tacsonia*, and the linear stipules of *Passiflora* sect. *Colombiana*. Finally, it is necessary to address a phylogenetic study to establish the relationships among the species of the section *Insignes*, with special focus on *P. lanceolata*.

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Authors' Contributions

GCC and RFH, contributed equally with the study design, data collection, discussion, and writing of the manuscript.

RFH contributed in the field collection of *Passiflora lanceolata*.

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